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Concept House
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Newport
South Wales
NP10 8QQ

01 AUG 2003

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I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

I also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Signed



Dated

14 July 2003



14JUN02 E7 676-1 002805
P01/7700 0 00-0213611.7

1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

M02B133/RJB

2. Patent application number

(The Patent Office will fill in this part)

0213611.7

13 JUN 2002

3. Full name, address and postcode of the or of each applicant (underline all surnames)

The BOC Group plc, Chertsey Road, Windlesham, Surrey, GU20 6HJ

Patents ADP number (if you know it)

884627002

If the applicant is a corporate body, give the country/state of its incorporation

England

884627002

4. Title of the invention

Vacuum Gauge

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

The BOC Group plc, Chertsey Road,

Fry Heath & Spence LLP
The Gables
Massetts Road
Horley
Surrey
RH6 7DA

20-6HJ

ADP NO - 08459554001

N. Jones

GRO7, 24/6/03

Patents ADP number (if you know it)

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description

Claim(s)

Abstract

Drawing(s)

0

3

1

0

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10. If you are also filing any of the following, state how many against each item.

Priority documents

0

Translations of priority documents

0

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

0

Request for preliminary examination and search (*Patents Form 9/77*)

1

Request for substantive examination (*Patents Form 10/77*)

0

Any other documents
(please specify)

0

11.

I/We request the grant of a patent on the basis of this application.

Signature

Date

12 June 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Roger Bousfield
(01276) 807612

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
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- d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- e) Once you have filled in the form you must remember to sign and date it.
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VACUUM GAUGE

The present invention relates to vacuum gauges.

Vacuum gauges are known which can measure pressures between 1×10^{-3} mbar to 2×10^{-3} mbar. Between 1×10^{-3} mbar and 1×10^{-2} mbar the vacuum gauges use the change in thermal conductivity of a gas as a function of gas pressure (as used in conventional Pirani gauges) in order to measure the pressure. At pressures in the order of 1×10^{-2} mbar and above, the thermal conductivity of the gas becomes independent of pressure. Increased sensitivity in this region is achieved by utilising the convection currents induced by a long hot electrical filament. The convection process involves cool air falling under gravity which is then drawn over the filament thereby cooling the filament. The power required to maintain the filament at the same temperature will therefore vary with pressure.

The optimum cooling is observed when the filament is orientated perpendicular to the direction of gravity, that is horizontally. For this reason known gauges have been designed to operate effectively only when mounted with the filament horizontal.

It is an aim of the present invention to provide a vacuum gauge which can be used in a plurality of orientations.

According to the present invention, a vacuum gauge comprises a gauge head having an inlet for connection to a vessel whose vacuum is to be measured, and an electrical filament mounted within the gauge head having directional component lengths in two orthogonal axes one being the axis used for connection to the vacuum vessel such that regardless of the orientation of the gauge head when connected to the vessel a substantial component of the filament will always be horizontal.

The vacuum gauge of the present invention makes use of the fact that all that is required to sustain convection when in use is a filament with a horizontal component. By mounting the filament such that it has directional component lengths in two orthogonal axes one being the axis used for connection to the vacuum vessel, a horizontal component is produced when the gauge head is mounted in various orientations.

An embodiment of the invention will now be described, by way of example, reference being made to the Figures of the accompanying diagrammatic drawing in which:

Figure 1 is a diagrammatic sketch of a vacuum gauge in a first orientation according to the present invention;

Figure 2 is a diagrammatic sketch of the vacuum gauge of Figure 1 in a different orientation;

Figure 3 is a diagrammatic sketch of the vacuum gauge similar to Figure 1 in yet a further orientation; and

Figure 4 is a diagrammatic sketch in which the vacuum gauge head shown in Figure 3 has been twisted about the longitudinal axis of the gauge head.

~~As shown, a vacuum gauge for measuring the vacuum in a vessel (not shown)~~
includes a gauge head 2 substantially closed but having an inlet at one end for connection to the vessel. Located within the gauge head 2 is an electrical filament 6. The filament 6, as shown with reference to Figure 1, is orientated at an angle θ degrees which is greater than zero measured with respect to the longitudinal axis X-X of the gauge head 2. In other words, the electrical filament 6 has directional component lengths in two orthogonal axes, one being the axis X-X used for connection to the vessel whose vacuum is to be measured.

It will be observed that by orientating the filament 6 at an angle θ degrees with respect to the axis X-X of the gauge head 2, the filament 6 has a horizontal component when mounted with the axis of the gauge head 2 horizontally (Figure 1), vertically (Figure 2) and orientations between Figures 1 and 2.

Provided that the filament 6 has a horizontal component, convection currents can occur and the power required to maintain the filament 6 at the same temperature will vary with pressure.

Referring in particular to Figures 3 and 4 in one orientation of the gauge head 2 the filament 6 (as illustrated in Figure 3) has no horizontal component. However, by simply rotating the gauge head 2 about its axis as illustrated in Figure 4, a horizontal component can be obtained.

Effectively convection based measurements of vacuum can be obtained with the gauge head 2 mounted in any orientation.

By mounting the filament 6 diagonally across the axis of the gauge head 2 a longer filament for a given outside dimension of the gauge head can be used. It also enables the vacuum gauge to be manufactured more easily and cheaply than known vacuum gauges.

CLAIMS

1. A vacuum gauge comprising a gauge head having an inlet for connection to a vessel whose vacuum is to be measured, and an electrical filament mounted within the gauge head having directional component lengths in two orthogonal axes one being the axis used for connection to the vacuum vessel such that regardless of the orientation of the gauge head when connected to the vessel a substantial component of the filament will always be horizontal.
 2. A vacuum gauge constructed, arranged and adapted to operate substantially as hereinbefore described with reference to and as illustrated in the Figures of the accompanying drawing.
-

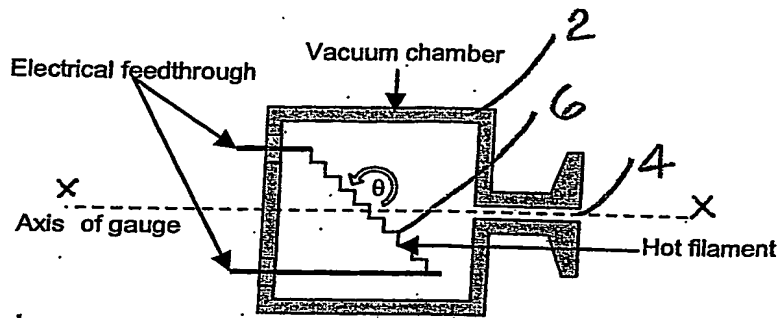


Figure 1

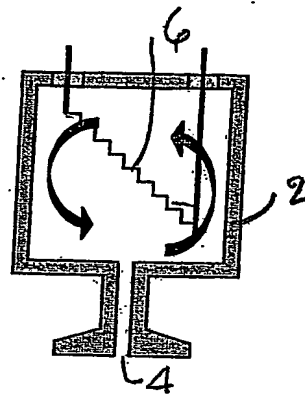


Figure 2

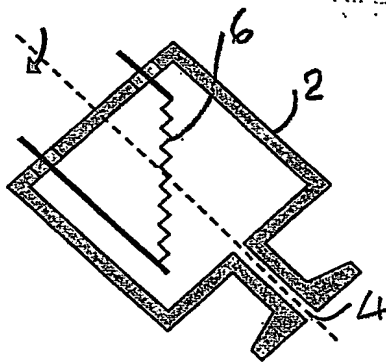


Figure 3

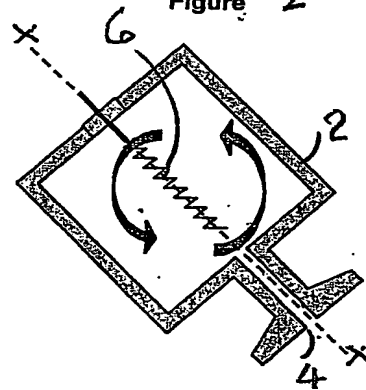


Figure 4